

A COMPARISON OF THE MALE GENITALIA OF THE PALAEOSETIDAE
WITH THOSE OF OTHER LEPIDOPTERA HOMONEURA.

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(Twelve Text-figures.)

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The lepidopterous family Palaeosetidae was described by Turner (*Proc. Ent. Soc. Lond.*, 1921, 599). Based on a study of the type, *Palaeoses scholastica* Turn., the family was assigned a position in the Hepialoidea of the Lepidoptera Homoneura, differing from the families Hepialidae and Prototheoridae in certain structural details of the wing venation, mouth parts and tibial spurs. Through the courtesy of Dr. Turner, the author has been able to examine the male genitalia of this interesting family, and the following is a comparison of these structures with those of other Lepidoptera Homoneura. An attempt is also made to express the characters offered by these structures in a numerical manner, much as Tillyard (*Proc. Linn. Soc. N.S.W.* 1919, 275-328) has done with the wing venation, and thus calculate the percentage of archaic characters preserved in the genitalia of each family.

In comparison with the genitalia of other Lepidoptera Homoneura the genitalia of *Palaeoses* (Text-figure 11) exhibit the following distinctive features. The eighth sternite is normal in size and shape, neither heavily chitinized, as it is in the Hepialidae, nor rudimentary or absent, as in the Micropterygidae. The ninth sternite or vinculum is U-shaped and of moderate size, as in certain Hepialidae, e.g. *Hepialus lupulinus* L. (Text-figure 7). The tegumen, or fused ninth and tenth terga, is narrow, emarginate on the meson of the dorsal surface and bears two pairs of anal processes, one pair caudad of the anus and the other slightly laterad. These processes closely resemble similar ones in the Prototheoridae (Text-figures 9 and 12), but are longer and more attenuate. Similar processes also occur in certain Hepialidae (Text-figures 8 and 10), but usually in this family the lateral pair are fused with the aedeagus and become a part of the intromittent organ. The pleural region of the tegumen in *Palaeoses* is expanded on each side and forms a pair of lateral lobes similar to those in certain species of *Micropteryx* (Text-figure 6), but directed inward rather than caudad as in *Micropteryx*.

The juxta consists of a quadrate chitinized plate situated on the meson directly caudad of the vinculum. It is similar to the same structure in the Hepialidae and Prototheoridae. The aedeagus, a recurved chitinized process, is articulated to the caudal margin of the juxta and forms the ventral support for the membranous penis. A similar type of aedeagus is present in many Hepialidae, *H. lupulinus* (Text-figure 7) *et al.* As will be seen in Text-figure 9, the aedeagus of the Prototheoridae is more complicated, having a large semi-membranous terminal portion armed with a pair of recurved processes and lateral lobes. The harpes or valves of *Palaeoses* are articulated to the lateral margins of

the juxta and each is divided into two areas, a narrow finger-like sacculus and a broad spoon-shaped cucullus. The harpes of the Prototheoridae and most Hepialidae are undivided, but a type somewhat similar to that of *Palaeoses* is to be found in *H. hectoides* Boisd. (Text-figure 8).

The male genitalia of *Palaeoses* have little in common with those of the Micropterygoidea which depart quite markedly from those of the Hepialoidea and approach the type of genitalia found in the primitive Tineoidea. Only in the Mnesarchaeidae (Text-figures 1, 4, and 5), are any distinct Hepialoid tendencies preserved. A U-shaped vinculum, similar to that of *Palaeoses* and many Hepialidae, occurs in this family, and *Mnesarchaea fusca* Philp. (Text-figure 5) possesses a pair of anal processes probably homologous with the more caudal pair of *Palaeoses* and *Prototheora*. The penis is membranous in the Mnesarchaeidae and is occasionally supported on the ventral side by chitinized spines, possibly the vestige of the aedeagus. In the Micropterygidae (Text-figures 3 and 6) and the Eriocraniidae (Text-figure 2) the aedeagus forms a tubular chitinized sheath for the penis, the juxta is greatly reduced in size and the harpes are often partially articulated to the vinculum.

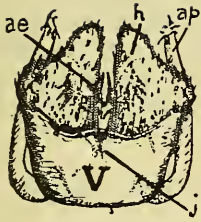
As previously mentioned a comparison of the archaic characters retained in the wings of the Lepidoptera Homoneura has been made by Tillyard. He used as the basis for this comparison the wing of *Belmontia*, the fossil ancestor of the Lepidoptera and Trichoptera, in which the maximum number of archaic characters were preserved. Unfortunately no such ancestral type of genitalia is at present known. From a study of the types of genitalia in the Lepidoptera and those insect orders closely related to the Lepidoptera, i.e. Neuroptera, Mecoptera and Trichoptera, some idea is obtained of the relative value of each structure comprising the genitalia complex and a hypothetical ancestral type may be postulated. The characters of such a type, as explained by the author in a previous publication (*Ann. Ent. Soc. Amer.*, 1924, 275-343), are as follows: Tegumen hood-like, composed of the fused ninth and tenth terga, often armed with one or more anal processes which seldom become definite enough in shape and position to be homologized with the uncus and gnathos of the Lepidoptera Heteroneura; vinculum composed of the ninth sternite which retains its normal shape and size; eighth sternite unmodified; harpes or valves undivided, at least in part articulated to a membranous or lightly chitinized basal plate or juxta; penis membranous and encased in a tubular, lightly chitinized aedeagus.

Text-figs. 1-12.

1. *Mnesarchaea hamadelpha* Meyr. Ventral aspect
2. *Eriocrania semipurpurella* Stph. Lateral aspect.
3. *Sabatınca chrysargyra* Meyr. Ventral aspect.
4. *Mnesarchaea loxoscia* Meyr. Ventral aspect.
5. *Mnesarchaea fusca* Philp. Ventral aspect.
6. *Micropteryx calthella* L. Lateral aspect.
7. *Hepialus lupulinus* L. Ventral aspect.
8. *Hepialus hectoides* Boisd. Ventral aspect.
9. *Prototheora petrosema* Meyr. Ventral aspect.
10. *Perrissectis australasiae* Don. Ventral aspect.
11. *Palaeoses scholastica* Turn. Ventral aspect.
12. *Metatheora corvifera* Meyr. Ventral aspect.

Abbreviations.

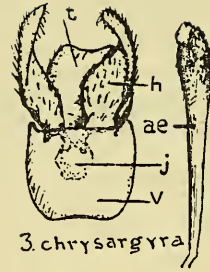
a—anus, *ae*—aedeagus, *al*—anal lobe, *ap*—anal process, *cuc*—cucullus, *h*—harpe or valve, *j*—juxta, *l*—lateral lobe of tegumen, *mp*—median process of tegumen (possibly the homologue of the uncus), *p*—penis, *sac*—sacculus, *S₈*—eighth sternite, *T₉*—eighth tergite, *t*—tegumen or fused ninth and tenth terga, *v*—vinculum or ninth sternite.



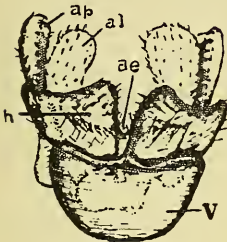
1. hamadelpha



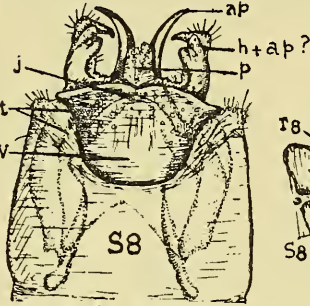
2. semipurpurella



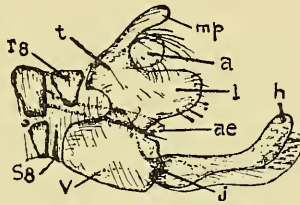
3. chrysargyra



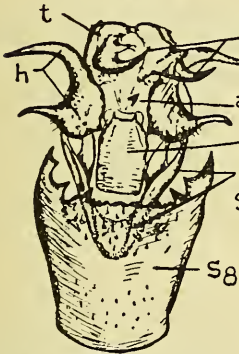
4. loxoscia



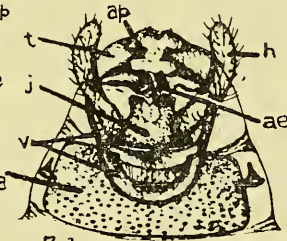
5. fusca



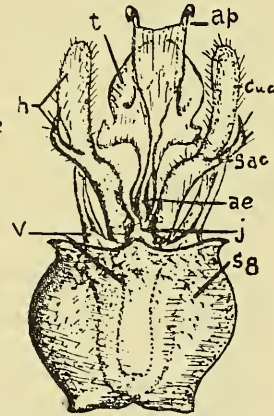
6. calthella



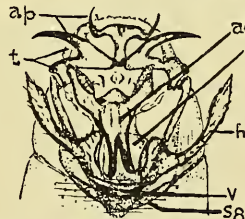
8. hectoides



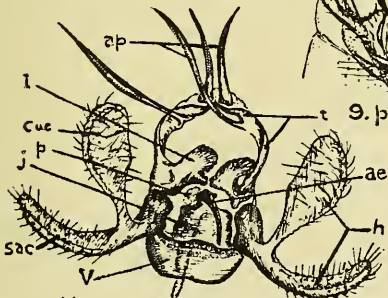
7. lupulinus



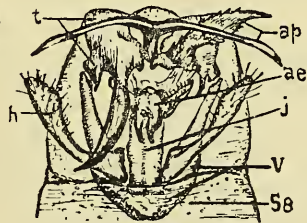
10. australasiae



9. petrosema



11. scholastica



12. corvifera

In the following table the characters of the male genitalia for the families of the Lepidoptera Homoneura, with the exception of the Anomosetidae, are summarized, together with calculations of the percentage of archaic characters retained by each. The hypothetical archaic type just described is regarded as possessing 100% archaic characters. Six characters are tabulated, each of which is regarded as a separate unit, and the extent to which each is retained in its primitive state in the different families is expressed in fractions of 100.

TABLE OF ARCHAIC GENITALIA CHARACTERS RETAINED IN FAMILIES OF LEPIDOPTERA HOMONEURA.

Character.	Micropterygidae.	Palaeosetidae.	Prototheoridae.	Hepialidae.	Mnesarchaeidae.	Ericranilidae.
Eighth Sternite:						
1. Normal, same shape and degree of chitinization as other abdominal sterna—100						
2. Hind margin heavily chitinized—66 $\frac{2}{3}$						
3. Entirely chitinized, plate-like—33 $\frac{1}{3}$	0	100	66 $\frac{2}{3}$	33 $\frac{1}{3}$	100	100
4. Dechitinized, vestigial or wanting—0						
Ninth Sternite: (Vinculum)						
Shape:						
1. U-shaped or quadrate, same size as other sterna—100						
2. U-shaped or quadrate, somewhat elongated—75						
3. Irregularly U- or V-shaped, elongated—50						
4. Emarginate, outer angles of front margin produced—25						
5. Narrowly transverse, often with saccus—0*						
Position:	87.5	100	75	25	100	37.5
1. Normal—100						
2. Front margin retracted beneath 8th sternite—50						
3. Entire sternum retracted beneath 8th sternite—0						
Tegumen: (Ninth and tenth terga)						
1. Hood-like—100						
2. Transverse with at least one pair of anal lobes—50						
3. Emarginate or completely divided, with one or two pairs of anal processes—0	100	0	0	0	50	50
Valves or Harpes: (Size and complexity)						
1. Large and simple—100						
2. Medium size, occasionally divided—75						
3. Medium size, invariably divided—50						
4. Usually small—25	100	50	75	75	25	0
5. Vestigial or absent—0						

TABLE OF ARCHAIC GENITALIA CHARACTERS RETAINED IN FAMILIES OF LEPIDOPTERA HOMONEURA.—(Continued.)

Character.	Micropterygidae.	Palaeosetidae.	Prototheoridae.	Hepialidae.	Mnesarchaeidae.	Eriocraniidae.
Juxta and Basal Attachment of Valves:						
1. Valves entirely attached to juxta, juxta large—100						
2. Valves one-half attached to juxta, juxta medium—66 $\frac{2}{3}$						
3. Valves one-third attached to juxta, juxta small—33 $\frac{1}{3}$	66 $\frac{2}{3}$	100	100	100	33 $\frac{1}{3}$	33 $\frac{1}{3}$
4. Valves entirely attached to vinculum, juxta absent—0*						
Aedeagus:						
1. Tubular, basal portion at least chitinized—100						
2. Semi-tubular, dorsal and ventral surfaces chitinized—75						
3. Plate or spine like—50						
4. Plate like with elaborate terminal armature—25	100	50	25	50	0	75
5. Vestigial or absent—0						
Average percentage preserved archaic characters	76	67	57	47	52	45

* Rarely found in Lepidoptera Homoneura but characteristic of certain Tineoidea and Macrolepidoptera.

Conclusions.

From the foregoing comparison it was seen that the male genitalia of *Palaeoses* possessed certain structures quite similar to or identical with those in the Prototheoridae and Hepialidae, i.e. the emarginate tegumen with two pairs of anal processes, the large juxta to which the harpes are entirely attached, and a non-tubular type of aedeagus. The vinculum, although shaped much like that of the Prototheoridae and certain Hepialidae is not retracted beneath the eighth sternite.

In the retaining of archaic characters, however, the genitalia surpass those of the Hepialidae and Prototheoridae and stand intermediate between the latter family and the Micropterygidae. As would be expected from the evidence offered by other structures, the Micropterygidae retain the greatest number of archaic genitalia characters in the families of the Lepidoptera Homoneura. In this respect the Eriocraniidae are the most specialized and the Mnesarchaeidae, which are less generalized than the Eriocraniidae in the matter of wing venation and mouth parts, retain more archaic characters than either the Eriocraniidae or the Hepialidae.